Center Independent Research & Development: GSFC IRAD

Near Earth Application of Delay/Disruption Tolerant Networking in Operational Networks

Completed Technology Project (2017 - 2018)

Project Introduction

In this internet age when a user sends an email to another user, rarely if at all do we think about the thousands of connections/links that exist in order for our email to arrive at another user's inbox. In like manner, DTN for space communications allows data to be transmitted to one node to another independent of whether or not there is a *current* data connection. DTN allows for an internet-like approach to spacecraft communications. The idea of this effort is to achieve technology maturation of exiting DTN implementations to allow for a clear infusion pathway for ground and flight use of DTN in operational systems.

Anticipated Benefits

There are many scenarios in spacecraft communications where the need for DTN is evident. Some of these include, but not limited to (1) Intermittent Connectivity (2) long or variable delay (3) asymmetric data rates (4) high communication error rates. . A combination of DTN and another technology called User Initiated Services (UIS) would move NASA networks toward this overtly seamless communication scheme seen in the cell phone industry and internet communication and ensure NASA leadership in that futuristic, but yet common approach.

The return on investment is clearly evident with the use of DTN in the NASA communication networks.

Current missions and future missions have increased the cost burden of ground communication links by pushing for near error free links. These "error-free" links are needed in the absence of automated confirmation of data delivery from the spacecraft. After a pass, if it is determined by the Mission Operations Center (MOC) or Science Operations Center (SOC) that not all the data was received, a command will be sent to the spacecraft on the next pass to retransmit the entire data set. Clearly not the most efficient way of transporting data. This would almost be equivalent to sending the same email multiple times a day because there is no way to be sure it would actually arrive at its destination. Millions of dollars (at Goddard alone) are spent to provide significant overhead into communication links to reduce the likelihood of retransmissions. An operational DTN implementation could greatly reduce this cost by automating confirmation of data delivery, where retransmission occur in realtime and can even be directed from a remote location (e.g. SOC or MOC).

DTN

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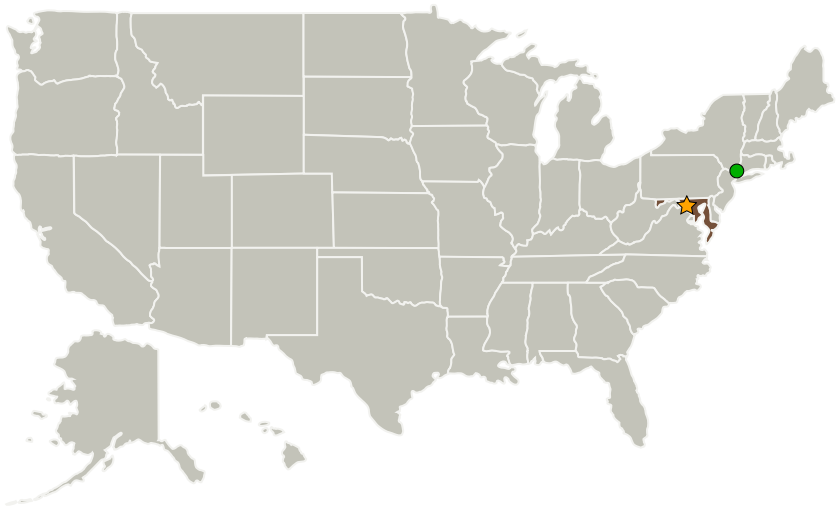
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
●Goddard Institute of Space Studies(GISS)	Supporting Organization	NASA Facility	New York, New York

Co-Funding Partners	Type	Location
Mission Support Directorate(MSD)	NASA Mission Directorate	

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Lavida D Cooper
Timothy D Beach
Wesley A Powell

Principal Investigator:

Philip J Baldwin

Co-Investigator:

Jonathan J Wilmot

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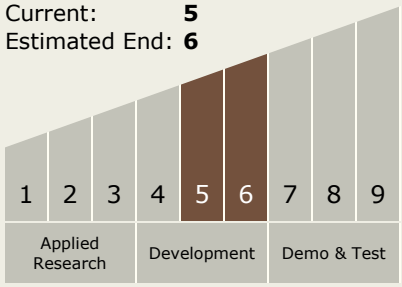
Images

DTN
DTN
(https://techport.nasa.gov/image/28289)

Technology Maturity (TRL)

Start: **5**
Current: **5**
Estimated End: **6**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.3 Internetworking
    - TX05.3.1 Disruption Tolerant Networking

Target Destinations

Earth, The Moon, Mars

Supported Mission Type

Projected Mission (Pull)